Section II (Remarks)

A. Summary of Amendment to the Claims

By the present Amendment, claims 37, 40, 41, 68, 70, and 71 have been amended. Claims 39 and 42 have been cancelled, without prejudice. The amendments to claims 37, 68, 70 and 71 are supported in the specification at paragraphs [0018]-[0023]. Claims 40 and 41 have been amended to properly depend from amended claim 37. No new matter within the meaning of 35 U.S.C. §132(a) has been introduced by the foregoing amendments.

The amendments made herein are fully consistent with and supported by the originally-filed disclosure of this application. Upon entry of the amendments, claims 37-72 will remain pending and under examination.

B. Response to July 14, 2010 Interview Summary

The Interview Summary mailed July 14, 2010 accurately summarizes the interview among Examiners Rebecca Fritchman and Krishnan Menon and Attorney Kelly Reynolds.

C. Rejection of Claims Under 35 U.S.C. §103

In the March 30, 2010 Office Action, all of pending claims 37-62, 64, 65, 67-72 were rejected under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 4,595,485 (hereinafter "Takahashi et al.") in view of or with further evidence from Bae, J-R, and Yun, S., *Jpn. J. Appl. Phys.*, vol. 37 (1998), pp. 2801-2802 (referred to by the examiner as "RIM," but referred to hereinafter as "Bae"). Applicants respectfully traverse the rejections.

As noted by the examiner in the Office Action mailed March 30, 2010, Takahashi et al. generally relates to "limiting electric current type oxygen concentration sensor[s]" which are used to measure the oxygen concentration in a gas (col.1, lines 10 to 15). The basic principle of this type of sensor is summarily described at col. 1, lines 18 to 31:

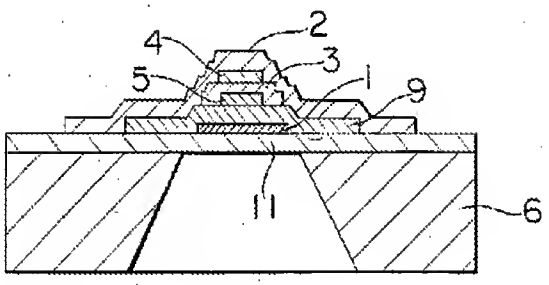
> "[e]lectrodes are formed to both major surfaces of an oxygen ionic conductive solid electrolyte plate, and an electric current flows through the solid electrolyte plate to move the oxygen for one direction. When a hermetic cover is provided for one of the electrodes, oxygen is supplied at a predetermined flow rate from an external source inside the cover, and a voltage is applied across two electrodes using the electrode at the side of the cover as a cathode, movement of

> oxygen ions can be effected in proportion to an amount of oxygen supplied thereto, so that an electric current flows from the anode to the cathode. The amount of oxygen flowing in the cover can then be calculated in accordance with the value of the electric current." (emphasis added.)

The sensor of Takahashi et al. includes sequentially stacked: a first electrode, a thin solid electrolyte thin film and a second electrode on a substrate, where the first and second electrodes are both gas-permeable (col. 2, lines 17-21).

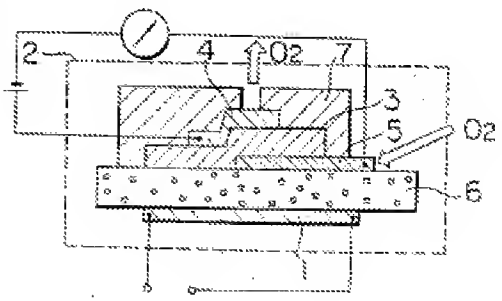
Fig. 11 illustrates the embodiment described at col. 9, lines 26-36, and cited by the examiner: "a sectional view showing a limiting electric current type oxygen sensor according to a fourth embodiment of the present invention ...[where a] thin SiO_2 insulating film 11, a heater 1, an Al_2O_3 or SiO_2 insulating film 9, cathode 5, thin solid electrolyte film 3, anode 4, and coating 2 are sequentially formed on one major surface of an Si substrate 6."

FIG. 11



In the sensors of Takahashi et al., oxygen is actively transported through an oxygen ionic conductive solid electrolyte by applying a current to this electrolyte using electrodes located at both sides of the electrolyte. The oxygen is converted into oxygen ions (see col.7, lines 10 to 20; Fig. 6) at the cathode before passing through the thin solid electrolyte film 3.

FIG. 6



In short, the limiting electric current type oxygen sensors of Takahashi et al. seek to measure the oxygen concentration in a gas, while applicants' claimed sensors measure gas permeation

properties of materials (*see* Specification, page 2, lines 1 to 3; page 3, paragraph [0013]; and Example 11).

In Takahashi et al. the amount of oxygen determines the electrical current flowing between the electrodes and through the electrolyte. The amount of oxygen can be calculated in accordance with the change in the electrical current.

By contrast, in applicants' claimed sensor, the electrical conductivity of the sensing element is changing due to the reaction of the material used for the sensing element with water and/or oxygen. The transformation of the sensing element results in a different electrical conductivity and thus allows determination of the permeation rate of the material tested (see also specification page 3-4, paragraph [0014]).

The reactivity of the components of the sensing element is further described in the specification:

> "[0023] ...The test material and the accompanying sensor is then exposed to an atmosphere containing the target gas which is reactive towards the sensing element. A predetermined quantity of the sensing element is used for the measurement, and the time taken for the sensing element to be partially or completely reacted can be determined. One possible way to do so is to measure the change in current flow over a period of time, and then calculate the projected time taken for the sensing element to be fully reacted. Another possible way is to monitor the ceasing of current flow through the sensor. For example, when the current flow ceases, the sensing element may be assumed to have reacted completely." (emphasis added)

Takahashi et al. does not demonstrate "...an electrically conductive sensing element that comprises a water and/or oxygen sensitive material, wherein the reaction of said material with water or oxygen when the sensing element is contacted with water and/or oxygen results in a change in the electrical conductivity of the sensing element...", as in applicants' claimed sensor.

It is therefore clear that applicants' sensor contains a sensing element that reacts with the water or oxygen and results in a change in electrical conductivity. In the Interview summary mailed July 14, 2010, the examiner noted that "if the material which is different in the instant application from the prior art which allows for this reaction to occur can be captured in the claims, the reference could be overcome."

In accordance with the examiners' suggestion, independent claims 37, 68, 70 and 71 have been amended to include recitation of the water and/or oxygen sensitive material as "selected from the

group consisting of metals of Group I of the periodic system of elements, metals of Group II of the periodic system of elements, iron, tin, chromium, conductive polymers, and mixtures and combinations thereof..." These specific elements of the sensing element are described in the specification at page 5:

> "[0018] The sensing element can comprise any suitable electrically conductive material which is sensitive to oxygen and/or water. This means that the material can be sensitive either to water alone, or oxygen alone, or both water and oxygen. Suitable materials include metals, metal alloys, metal oxides, conductive polymers, as well as mixtures and combinations thereof." (emphasis added)
>
> "[0019] In principle, all metals that can react with water and oxygen can be used as the sensing element or within the sensing element. Such metals include highly reactive metals such as the Group I elements (for example, sodium and potassium), moderately reactive metals such as Group II elements (magnesium, calcium, barium) and transition metals such as iron, tin and chromium. Particularly suitable metals are calcium and magnesium. Apart from being reactive towards water and oxygen, they also can be readily processed into any suitable shape and dimension, such as blocks, strips or thin films." (emphasis added)

By contrast, in Takahashi et al., claims 2, 9, 21 and 25 recite a sensor with a thin solid electrolyte film comprising "zirconium oxide stabilized by at least one stabilizer selected from the group consisting of yttrium oxide, ytterbium oxide, gadolinium oxide, magnesium oxide, calcium oxide, and scandium oxide..." Takahashi et al. do not recite a sensor "wherein the water and/or oxygen sensitive material is selected from the group consisting of metals of Group I of the periodic system of elements, metals of Group II of the periodic system of elements, iron, tin, chromium, conductive polymers, and mixtures and combinations thereof..."

Independent claims 37, 68, 70 and 71, as amended, contain recitation of the material that reacts with the water and/or oxygen and results in change of the electrical conductivity of the sensing element. Such distinction, as acknowledged by the examiner in the Advisory Action mailed July 14, 2010, is sufficient to overcome Takahashi et al.

In the Office Action mailed March 30, 2010, the examiner further asserted that the "liner/insulating layer" in Takahashi is anticipatory of applicants' claimed "liner layer interdisposed between the sensing element and the base substrate, wherein the liner layer comprises an organic polymer and/or an inorganic polymer" when Takahashi et al. is viewed with Bae et al., as "...it would be obvious to one of ordinary skill from RIM ...that the SiO_2 in

Takahashi is a polymer due to the fact that RIM et al. teach of silicon dioxide being a polymer..." (Office Action mailed March 30, 2010, p. 3.)

As set forth in detail above, the claims are not obvious in view of Takahashi et al. and citation of Bae does not remedy the deficiencies of Takahashi et al.

The "liner layer" within applicants' claimed sensor is described in the specification as behaving:

> "...as a buffer region which sponges up (saturate with) the permeating gases before they are desorbed homogeneously. The homogeneous desorption of the permeating gases results in the uniform degradation of the sensing element, which in turn enables the decrease in electrical conductivity of the sensor to be more accurately correlated to the decrease in thickness of the sensing element."

This behavior is confirmed by Example and Figs. 11, where non-uniform degradation of calcium was observed without use of a liner layer, but uniform degradation was observed in the presence of a liner layer.

By the above discussion it is not meant to impermissibly read limitations of the specification into the claims, but it is provided to assist in the interpretation of the recited "liner layer" and to clarify why the recited positioning of such liner layer is essential.

The insulating layer of a sensor of Takahashi et al. is illustrated in Fig. 11 (element 11), Fig. 17 (element 12) and Fig. 19 (element 11) and is positioned between the substrate and the cathode, "so as to avoid gas diffusion flow from the cathode side." (col. 2, lines 32-33.)

As such, Takahashi et al. does not demonstrate "...a liner layer interdisposed between the sensing element and the base substrate, wherein the liner layer comprises an organic polymer and/or an inorganic polymer...," as in applicants' claimed sensor.

All of independent claims 37, 68, 70 and 71 recite a liner layer. All of claims 38, 40, 41, 43-62, 64, 65, 67, 69, and 73 depend directly or indirectly from claims 37, 68, 70 or 71 and therefore are patentable for the same reasons advanced above in support of the patentability of claims 37, 68, 70 and 71.

In rejecting dependent claim 40, the examiner alleges that "Takahashi et al. teach of the metal for the metal oxide being magnesium or calcium..." Applicants note that claim 40, as amended,

depends from claim 37 and the recitation of a metal therein. Claim 40 has been amended to depend directly from claim 37, in view of the cancellation of claim 39.

A basic measuring principle of the present invention relies on the transformation of metals, such as calcium and magnesium, into metal oxides. Therefore, claim 40 does not refer to a base metal of a metal oxide and is not obvious in view of magnesium oxide or calcium oxide in claims 2 and 4 of Takahashi et al.

Claim 42 has been cancelled by the present response. The rejection of claim 42 is therefore moot.

Based on the foregoing, Takahashi et al. in view of Bae et al. fails to provide any derivative basis for the claimed invention, a sensor, method, or system comprising "...an electrically conductive sensing element that comprises a water and/or oxygen sensitive material, wherein the reaction of said material with water or oxygen when the sensing element is contacted with water and/or oxygen results in a change in the electrical conductivity of the sensing element..." and wherein the water and/or oxygen sensitive material is "selected from the group consisting of metals of Group I of the periodic system of elements, metals of Group II of the periodic system of elements, iron, tin, chromium, conductive polymers, and mixtures and combinations thereof," as in applicants' claims.

Takahashi et al. in view of Bae et al. does not render the claimed invention obvious. Accordingly, withdrawal of the rejection of claims 37, 38, 40, 41, 43-62, 64, 65, and 67-72 under 35 U.S.C. § 103(a) as being obvious over Takahashi et al. in view of or as evidenced by Bae et al. is respectfully requested.

CONCLUSION

Based on the foregoing, all of applicants' pending claims 37, 38, 40, 41, 43-62, 64, 65, and 67-72 are patentably distinguished over the art, and in form and condition for allowance. The examiner is requested to favorably consider the foregoing and to responsively issue a Notice of Allowance.

The time for responding to the March 30, 2010 Office Action without extension was set at three months, or June 30, 2010. Applicants hereby request a three month extension of time under 37 CFR § 1.136 to extend the deadline for response to September 30, 2010. Payment of the

extension fee of $1110.00 specified in 37 C.F.R. § 1.17(a)(3), as applicable to large entity, is being made by on-line credit card authorization at the time of EFS submission of this Response. Should any additional fees be required or an overpayment of fees made, please debit or credit our Deposit Account No. 08-3284, as necessary.

If any issues require further resolution, the examiner is requested to contact the undersigned attorneys at (919) 419-9350 to discuss same.

Respectfully submitted,

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